World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:5, No:11, 2011

# The Recession as an Opportunity for Curbing Transport Emissions

Gabor Szendro, Maria Csete, PhD

***Abstract*—**The effects of the transport sector on the environment are a well-recognized issue in the European Union and around the world. This area is a subject of much discussion as to how these negative effects could be minimized, especially with regards to impacts contributing to climate change. This paper aims to investigate the results of the economic crisis and how its consequences could be exploited to combat air pollution.

***Keywords*—**Air pollution, climate change, recession, transport



## I. Introduction

THE role of the transport sector in the economy of Europe (and indeed, the world) is enormous. Mobility is not only the lifeline of international trade, it is also vital for generating employment and economic growth, and is an important factor in sustaining and improving the quality of life of 500 million European citizens. The European transport sector directly employs 10 million people and accounts for 5% of GDP [1].

It would not be possible nor wise to replace transportation entirely as it is an integral part of the production chain: manpower, stock, semi-finished and finished products must be transported. In recent years, as the effects of current methods to reduce GHG emissions from the transport sector have been reviewed, it has become clear that technological solutions have proven insufficient to handle the negative impacts of transportation (this includes external effects, such as pollution or congestion). As an alternative and accompanying measure, demand management has become one of the cornerstones of transport policy measures in the EU. These measures include the development of public transport that is affordable, sustainable while also meeting the needs of the local population in order to be successful in competing with individual (passenger car) transport in both costs and level of comfort. Other methods use a different approach, such as congestion charging, a measure that has been introduced in several cities in Europe and around the world, with methods and schemes almost as varied as the success of introduction[2]. At the same time, incentive systems have been created and targets have been set (the most recent being the newly released White Paper on Transport by the European Commission), sometimes before the effects of measures (e.g. first generation biofuels) and the implications of their widespread use were fully understood [3].From the very beginning, even as a series of significant advances have been achieved in efficiency, build quality, noise and emissions, etc., the core technology behind the passenger car – the internal combustion engine – has changed little. This fact not only has consequences on how we experience travel, it is also significant from the point of view of energy security, sustainability and climate change mitigation.

In the short and medium term (up to 15-20 years ahead), despite technology and policy efforts, and the evolution in transport behavior, it is unlikely that the internal combustion engine will be replaced as the mainstay power source in the majority of passenger cars manufactured for the mass market. Although there are plenty of alternatives, and the role of technological advances in mobility should not be understated, some of the alternatives under development are either in the early stages (i.e. hydrogen), facing technical, adaptation or ethical issues (biofuels), would require considerable investment in infrastructure (hydrogen, CNG), or are not competitive on their own, without subsidies by governments (most of the above).

Congestion has become a major problem in most European capitals and larger cities. Several responses and alternative solutions have been developed to deal with this issue, such as congestion charging (a measure looking forward to wider adaptation, occasionally more for fiscal rather than transport policy reasons) with mixed success. Facing these challenges, as well as the need and international agreement to drastically cut GHG emissions (in order to limit global warming to 2 °C), the European Union has set the target of eliminating conventionally fueled cars fro cities by 2050 in the recently released Transport White Paper. For the medium term, the goal is to reduce GHG emissions by 20% from 2008 levels.
The following paragraphs will aim to investigate the links between transport performance, the economy and the environmentand how the effects of the economic crisis could provide an opportunity in this field.

## II. Links between Transport, Economy and the Environment

It has been clear for some time that the transport sector, the economy and the state of the environment are interlinked, however the relationships are multidirectional and complex, making true comprehension of the forces involved difficult.

One of the first and most basic models to try to describe this system is the IPAT-equation, as put forward by Ehrlich and Holdren in 1971[4]:

$$I=P\times A\times T, \text{ where} \quad (1)$$

Gabor Szendro is with the Budapest University of Technology and Economics, Department of Environmental Economics, Budapest, Hungary (phone: 0036-1-463-2018; fax: 0036-1-463-1149; e-mail: szendro@eik.bme.hu).

Maria Csete, PhD is with the Budapest University of Technology and Economics, Department of Environmental Economics, Budapest, Hungary (phone: 0036-1-463-2018; fax: 0036-1-463-1149; e-mail: csete@eik.bme.hu).

I: Impacts [GHG emissions]
P: Population
A: Affluence [GDP/capita]
T: Technology [carbon intensity, GHG emissions/unit of income]

Although the predictive power of this model is insufficient to use it for forecasting, it provides a good illustration of the forces involved. When looking at the factors of (I) from a global perspective, it is evident that the current trajectory is not sustainable. Population (P) is growing at an exponential pace; incomes (A) are also increasing. To offset these effects, carbon intensity (T) should be decreasing drastically, which is not happening.

The strong links between transport, economy and environment can be further demonstrated by looking at past trends. Fig. 1 plots GDP/capita in constant US dollars against the motorization index in the EU-27:

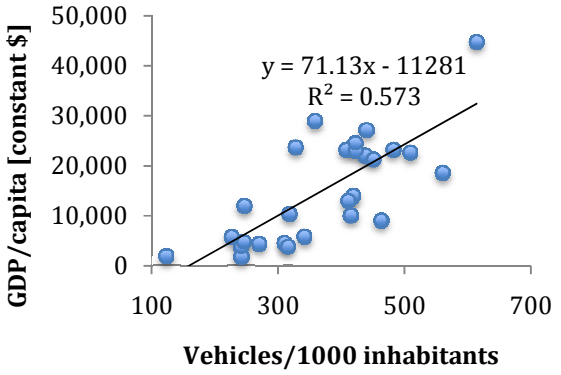


Fig. 1 Motorization and affluence (10-year averages, EU-27)
Source: Own work, data from [5]

As Fig. 1 clearly shows, there is a positive correlation between income and the motorization level.It is worth noting that the outlying value in the upper right section of the graph represents Luxembourg.

The relationship between motorization and emissions can be seen in Fig. 2.

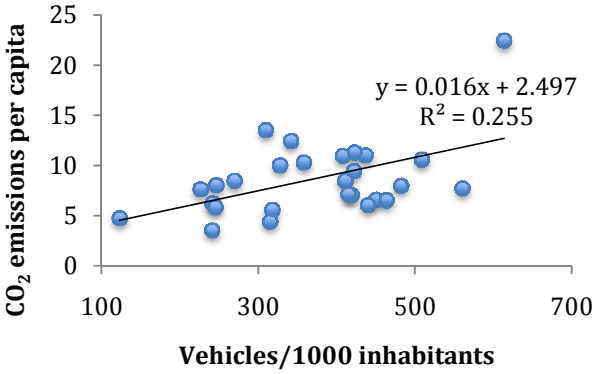


Fig. 2 Motorization and pollution (10-year averages, EU-27)
Source: Own work, data from [5]

The relationship between $CO_2$ emissions and pollution is also clear, albeit less pronounced than between motorization and GDP (the outlying value is again Luxembourg).

While the correlation is evident in both cases, the direction (causality) is not well understood (i.e. whether affluence induces increased travel or vice versa). It is also worth mentioning that with better vehicles and infrastructure, the distances traveled have increased significantly since the rise of the automobile. In other words, despite the changes in social, economic and technological structures, not to mention policy changes, Marchetti's constant (postulating that people tend to travel approximately 90 minutes a day) holds surprisingly well, and as the time spent traveling each day seems to stay constant, what has increased drastically in the last decades is the distance traveled.

## III. Supply Security

Apart from environmental concerns, the current state of affairs in transport is also unsustainable from a supply security perspective. If nothing is done (Business As Usual), the oil dependence of this sector will remain around 90%, which is a risk to Europe's economy as prices have historically been closely correlated with geopolitical events. Fig. 3 plots oil prices in constant US dollars over time as far as the records go back (1861), with some major recent historical events at key points of the graph.

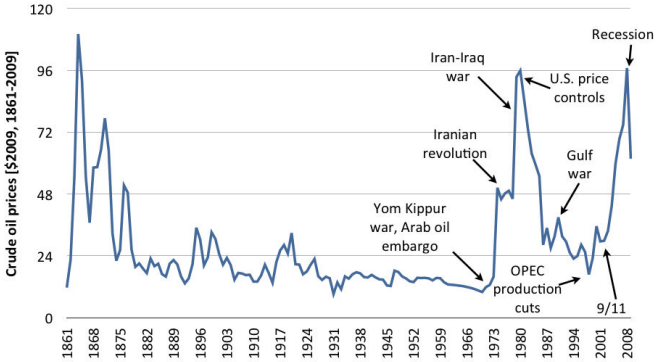


Fig. 3 Oil prices and geopolitical events Source: [6]

It is clear from Fig. 3 that modern geopolitical events have had a major impact on oil prices, and, as a result of oil dependence, on the state of the economy. The trends of the near future are likely to include the following [7]:

1. Oil prices will continue to increase
2. Risks associated with oil production and use will stagnate or escalate
3. Transport demand will increase
4. Environmental regulations will become more stringent
5. Demand will shift away from the EU and the US

As these trends will shape the near future (at least until 2020, some beyond), it will become increasingly important and costly to attempt the "greening" of transport, while the shift in demand will dramatically reduce the effectiveness of policies enacted in OECD countries.

Increasing transport demand is creating severe problems in the developed world because of harmful impacts and congestion, but the same trend is experienced in developing countries and transition economies as well. While in

developing countries the motorization index usually stays below 200 (cars per 1000 inhabitants), most estimations agree that the majority of demand for both energy and vehicles will not be originating from OECD countries for long.

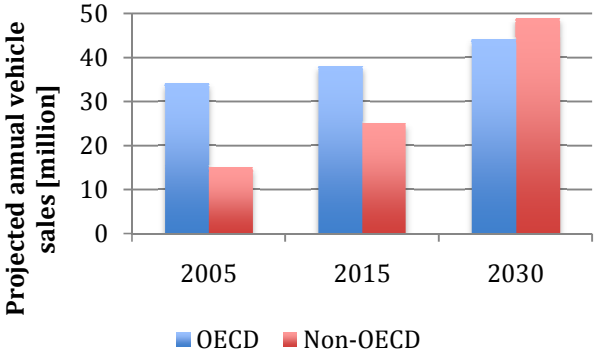


Fig. 4 Demand shift to developing countries Source: [8]

It is clear from Fig. 4 that there is not much time before policies and protocols agreed upon by the countries active in this field today will have limited global effect unless countries such as China and India also become signatories of these agreements (which they currently seem reluctant to do). It is also important to note that transport is not the only field where this process is happening, energy demand shows a very similar picture.

In light of these developments, it is even more important to use the time and resources available to the best effect possible, even using events such as the economic recession to achieve results in this field.

## IV. The Recession – An Opportunity?

The economic slowdown Europe and the World are experiencing right now is not the first, and it is unlikely to be the last (in fact, past recessions and other events such as the oil embargo of '73 were even more dire in their consequences with regards to economic performance and employment). However, it would seem that the current recession is different in its consequences as far as sustainability and the "green" agenda is concerned.

Traditionally, these considerations were usually discarded in times of economic hardships as funds and efforts were instead dedicated to other functions in the system as competitive pressures increased. The current situation is not the same, however. The following paragraphs will attempt to investigate the differences between past crises and the present one to determine the success factors for sustainable development in the near future.

First of all, some alternatives we now call sustainable were present from the very beginning of the age of the automobile (electric cars, bioethanol, vegetable oils, etc.). As the scale of motorization did not require it, environmental considerations played no part in their use; they were selected based on merit with engineering in mind. As oil became a cheap and readily available alternative, most other technologies were discarded, especially as the supply security issue was non-existent.

In contrast, technological sustainable transport solutions today are mostly unable to compete with fossil fuels (without subsidies), but have the full backing of policy and the need to increase supply security.

Environmental awareness with respect to the economy and transport is a relatively new concept, and its enforcement is one of the key differences between this crisis and the ones before it. However, awareness about environmental issues has proven to be insufficient to radically change consumer behavior, especially with regards to transport. This is known as the value-action gap, whereby individuals, although aware of the consequences of their actions and the detrimental effects they may have on the environment do not translate their beliefs to actions. Indeed, as opposed to the expected causality where attitudes shape and define behavior, the environmental issue is one of the fields where the opposite (i.e. behavior modifies attitudes) can sometimes be experienced. Overcoming this phenomenon is one of the most important challenges for policymakers in order to make policies in this field (more) effective.

However, the presence of environmental issues in the media and public discussion on the subject have apparently met with the technological advances to increase the competitiveness of alternative solutions just enough that they can be considered. The need for action in unison on the part of Member States to meet the goals set out in the White Paper will also improve the situation.

When a consumer choice is made, many factors contribute to the final decision (performance, price, and so on). Improving technology and competitiveness takes the value-action gap out of the picture by substituting environmental consciousness with price sensitivity (or utility), a primary consideration in an economic downturn.

The economic recession has not only decreased spending; it has also defied trends in the energy sector, resulting in decreasing demand in some countries for the first time in 20 years. Although it has also resulted in falling oil prices (see Fig. 3), but these were only temporary. More recent events, such as the Arab Spring (missing from Fig. 3 because of data availability), and, in the long run, scarcity of supplies will not only drive the price up at the pumps, but external and environmental costs will also increase as offshore drilling and other forms of extracting oil become financially viable (a prominent example is the Deep Water Horizon).

Meanwhile, while alternatives such as electric propulsion started out as extremely expensive, status-symbol solutions with vehicles such as the Tesla Roadster, costing upwards of €100 000, automobile manufacturers are coming out with new, more affordable models to meet consumer demand in lower price categories as the cost of electric propulsion is starting to gain a competitive edge against conventional fossil fuels. The same is true of converter kits for conventional engines to use CNG or LPG, as well as hybrid technologies and so on. The number of different alternative fuel vehicles (AFVs) available on the market describes the situation well:

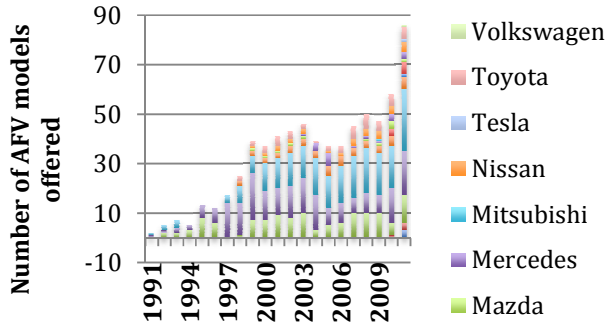


Fig. 4 Alternative fuel vehicle models on the market Source: [9]

The data clearly shows a slight decrease in the number of models available in 2009, just as the effects of the recession have started to be felt in this sector (cutting back on available models takes time), but there is a quick rebound in 2010, followed by an unprecedented increase in 2011.

This is partly the result of the automobile manufacturers widening the palette of their offerings while using lower or zero tailpipe emissions as selling points to environmentally sensitive customers, while upkeep costs are also becoming more important, potentially overcoming some of the initial barriers to entry, such as missing infrastructure (e.g. electric charging stations) for several alternative propulsion technologies (although it should be noted that there have been considerable efforts to improve this situation, charging stations have been opened at many sites in Europe, for example).

Of course, the number of vehicles bought by consumers has seen a sharp decline in all segments in 2008 and 2009 (with the exception of a few brands that are mostly present in the luxury market and as such, their customers were not as severely affected by the crisis), but as time progresses, sales will eventually increase again in the lower segments as well, with fuel costs becoming more and more important when selecting a model. The possible long-term savings can be illustrated by comparing the prices of conventional fuels and electricity:

TABLE I
FUEL AND ELECTRICITY PRICES

| | Gasoline price (€/l) | Diesel price (€/l) | Electric cost (€/kWh) | €/100 km gasoline | €/100 km diesel | €/100 km electric |
|---|---|---|---|---|---|---|
| **Norway** | 1.51 | 1.38 | 0.11 | 11.92 | 9.27 | 1.64 |
| **Great Britain** | 1.27 | 1.28 | 0.13 | 10.02 | 8.64 | 2.03 |
| **France** | 1.29 | 1.18 | 0.09 | 10.17 | 7.95 | 1.34 |
| **Germany** | 1.33 | 1.13 | 0.13 | 10.46 | 7.64 | 2.03 |
| **Netherlands** | 1.46 | 1.13 | 0.13 | 11.48 | 7.64 | 2.09 |
| **China** | 0.67 | 0.61 | 0.05 | 5.31 | 4.10 | 0.82 |
| **United States** | 0.37 | 0.60 | 0.08 | 4.41 | 4.06 | 1.32 |

Source: [10], data from 2010

The gains in operating costs are easily seen in Table 1, and although the price of most AFVs is considerably higher, savings can amount to €1000 and more depending on annual mileage.

While the emissions of the alternatives should be carefully evaluated (with electric cars, this especially refers to electricity generation), it appears that the economic downturn has not limited the supply of new alternatives, but instead has provided an incentive to consider sustainable transport solutions. As more and more options are available to consumers, alternative fuel vehicles will become a viable choice for prices affordable to more customers than in recent years.

This development should not only be realized by policy- and decision makers, it should also be recognized as an outstanding opportunity in the field of sustainable transport. Fiscal and policy tools will have to be used in conjunction not only to achieve the self-imposed targets of countries, such as the 20-20-20 strategy of the EU, but also to create a more sustainable transport system going forward.

## ACKNOWLEDGMENT

This work is connected to the scientific program of the "Development of quality-oriented and harmonized R+D+I strategy and functional model at BME" project. This project is supported by the New Széchenyi Plan (Project ID: TÁMOP-4.2.1/B-09/1/KMR-2010-0002).

## REFERENCES

[1] European Commission: *"Roadmap to a Single European Transport Area – Towards a competitive and resource-efficient transport system"*, pp. 5, 2011.
[2] G. Szendro, "Congestion charging in Budapest – a comparison with existing systems", *Periodica Polytechnica*, To be published.
[3] G. Szendro, „Sustainable biofuels in Hungary and Europe – self-defeating incentives?" *Gazdálkodás Scientific Journal on Agricultural Economics, English Special Edition*, pp. 71-78, ISSN 0046-5518, 2010.
[4] P. R. Ehrlich, J. P. Holdren, "Impact of population growth", *Science,* 1971.
[5] The World Bank: "World Development Indicators & Global Development Finance", 2010
[6] British Petrol: Statistical Review of World Energy 2011
[7] G. Szendro, M. Csete, A. Torok,"Unbridgeable gap between transport policy and practice in Hungary", *Journal of Environmental Engineering and Landscape Management*, To be published.
[8] International Energy Agency, FIA Foundation: *"50 by 50, global fuel economy initiative"*, pp. 6., 2008.
[9] http://www.afdc.energy.gov/afdc/data/vehicles.html, accessed 2011.09.19
[10] http://www.eurocarblog.com/post/3322/electric-cars-europe-vs-the-us, accessed 2011.09.19